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Supervised exercise delivered via telehealth in real-time to manage chronic conditions in adults: A protocol for a scoping review to inform future research in stroke survivors

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Title: Supervised exercise delivered via telehealth in real-time to manage chronic conditions in adults: A protocol for a scoping review to inform future research in stroke survivors

Authors:

1. Emily R. Ramage, BPhysio (Hons),
PhD Candidate, School of Health Sciences, University of Newcastle, Australia,
Department of Physiotherapy, Western Health, St Albans, Australia
Centre for Research Excellence in Stroke Recovery and Rehabilitation, Florey Institute of
Neuroscience and Hunter Medical Research Institute, Australia
Email: emily.ramage@uon.edu.au Twitter: @EmilyRRamage
2. Natalie A. Fini, BPhysio (Hons), Grad Dip Rehab,
PhD Candidate, La Trobe University, Bundoora, Australia
Lecturer, Department of Physiotherapy, Melbourne School of Health Sciences,
the University of Melbourne, Australia
Email: natalie.fini@unimelb.edu.au Twitter: @NatFiniPhysio
3. Elizabeth A. Lynch, PhD
Research Fellow, Adelaide Nursing School, University of Adelaide
Email: elizabeth.lynch@adelaide.edu.au Twitter: @E_A_Lynch
4. Amanda Patterson, M Nutr & Diet, PhD
Senior Lecturer, School of Health Sciences and Priority Research Centre for Stroke and
Brain Injury, University of Newcastle, Australia
5. Catherine M. Said, PhD
Associate Professor Physiotherapy, Western Health, Furlong Rd, St Albans, Australia

Physiotherapy, University of Melbourne, Parkville, Australia

Australian Institute for Musculoskeletal Science, Furlong Rd, St Albans, Australia

Phone +61 3 8395 8106, email csaid@unimelb.edu.au; Twitter @cathy_said

6. Coralie English, PhD

Associate Professor, School of Health Sciences and Priority Research Centre for Stroke and Brain Injury, University of Newcastle, Australia

Centre for Research Excellence in Stroke Recovery and Rehabilitation, Florey Institute of Neuroscience and Hunter Medical Research Institute, Australia

Phone: +61 2 4913 8102 E-mail: Coralie.english@newcastle.edu.au Twitter: @Coralie_English

Correspondence (for review):

Name	Emily Ramage
Department	School of Health Sciences
Institution	University of Newcastle
Country	Australia
Tel	+61 408 669 204
Mob	+61 408 669 204
Fax	
Email	emily.ramage@uon.edu.au

Correspondence (for publication)

Name	Emily Ramage
Department	School of Health Sciences
Institution	University of Newcastle
Country	Australia
Email	emily.ramage@uon.edu.au

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Ethics approval: The review will utilise only secondary de-identified data and therefore ethics approval is not required

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ABSTRACT

Introduction: Increasing physical activity reduces secondary stroke risk factors, but many stroke survivors have low levels of physical activity. Supervised exercise delivered via telehealth has the potential to overcome barriers to increased physical activity in stroke survivors. Our scoping review will examine the emerging field of supervised exercise delivered via telehealth to map the available evidence in relation to its efficacy, acceptability, safety and feasibility in chronic conditions to inform future research into its ability to increase physical activity.

Methods and analysis: The methodological framework of Arksey and O'Malley will be applied to our scoping review. A systematic search of (Medline, CINAHL, Scopus, Cochrane, Pedro and Embase); hand searching of pertinent studies' reference lists; and consultation with experts in the field will identify relevant papers. Studies involving subjects with a chronic condition who undertake supervised exercise delivered by a health professional via telehealth targeted at improving secondary stroke risk factors or involving lower limb weightbearing exercise will be included. Study selection and critical appraisal of individual studies will be carried out independently by two authors with discrepancies resolved by a third author. Quantitative data will be charted. Qualitative data will be extracted, thematically analysed and charted alongside. Results will be tabulated and narratively summarized to highlight findings relevant to the review's research questions and inform recommendations for future research.

Ethics and dissemination: Our review will significantly contribute to the knowledge base of

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3 exercise and rehabilitation delivered via telehealth and its application in chronic conditions,
4 including stroke. Findings will be relevant to researchers, healthcare workers and policy makers
5 and will be disseminated through publication and presentations. Only secondary de-identified data
6 will be included, therefore ethics approval will not be sought.
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12 This protocol is not registered as PROSPERO currently excludes scoping reviews.
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14 *Keywords:* Telehealth, telerehabilitation, supervised exercise, stroke, physical activity, secondary
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Strengths and limitations of this study:

- Our comprehensive scoping review will bring together research findings regarding supervised exercise delivered via telehealth to inform its future application to research and practice across chronic conditions
- The inclusion of all research study designs will ensure the breadth of evidence regarding supervised exercise delivered via telehealth is captured
- We will use a published framework to optimise transparency and methodological rigor
- To facilitate accurate analysis of the evidence and its role in informing future research, quantitative studies will be individually assessed for bias and qualitative studies will be individually assessed for methodological rigor
- A limitation of this review will be the exclusion of unpublished literature for which authors are unable to provide sufficient additional information, and research not published in English.

Introduction

Stroke is the second leading cause of death and burden of disease worldwide^{1 2}. The number of people experiencing stroke is increasing, with estimates predicting 70 million stroke survivors and 12 million stroke related deaths worldwide in 2030³. Secondary prevention of stroke is currently inadequate with incidence rates as high as 40%⁴. Secondary strokes tend to be more severe with a mortality rate nearly double that of first stroke⁵. Effective secondary prevention strategies must be significantly improved to prevent the impact of stroke recurrence.

Lifestyle interventions which involve increasing physical activity in stroke survivors can improve secondary stroke risk factors^{6 7}. Despite this, stroke survivors frequently have low activity levels⁸⁻¹⁰. Simply providing prompts and encouragement is not sufficient to achieve increases in physical activity in stroke survivors⁹. Supervised exercise has the potential to facilitate secondary stroke prevention as it is superior to unsupervised exercise in increasing long-term physical activity levels in stroke survivors¹¹. Stroke survivors have identified that support provided by qualified staff during supervised exercise was a key facilitator for increasing physical activity¹². Supervised exercise also improves walking ability¹³, mobility¹⁴, balance¹⁴ and endurance¹⁴ in stroke survivors; all key elements of physical function which are positively associated with physical activity levels in this population¹⁵.

Barriers to physical activity identified by stroke survivors include transport^{16 17}, economic constraints¹⁶, distance¹⁷ and a perceived lack of appropriate services¹⁶. Marzolini, et al. (2016) found that barriers to physical activity identified in their study also increased with increased socioeconomic disadvantage¹⁷. Telehealth uses “telecommunications and virtual technology to

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3 deliver health care outside of traditional health-care facilities¹⁸. This rapidly evolving mode of
4 service delivery has significant potential to improve equity of service delivery and overcome
5 barriers such as access, distance, cost and transport. Evidence is emerging across chronic
6 conditions regarding the application of supervised exercise delivered via telehealth¹⁹⁻²⁴.
7 Preliminary research indicates these interventions may be feasible²¹, improve self-efficacy²⁰ and
8 reduce costs of exercise program delivery²⁴.
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12 Stroke related impairment may impact the safety and efficacy of supervised exercise delivered via
13 telehealth to reduce secondary stroke risk factors. Stroke survivors are commonly affected by
14 impaired cognition²⁵, physical ability^{26 27} and post stroke fatigue²⁸. Internationally, the potential for
15 supervised exercise to optimise stroke survivor safety is recognised. The American *Physical*
16 *activity and exercise recommendations for stroke survivors*²⁹ and the *Canadian stroke best practice*
17 *recommendations: Secondary prevention of stroke*³⁰ suggest the consideration of health
18 professional supervised exercise where co-morbidity^{29 30}, falls risk³⁰ and level of disability²⁹
19 present a risk. Seventy-nine percent of stroke survivors are reported to have at least one
20 cardiovascular co-morbidity, while over a quarter have at least two³¹. Falls are common post
21 stroke³²⁻³⁴ and 45% of community dwelling stroke survivors have been found to fall at least once in
22 a twelve month period³⁴. Opportunity for effective, accessible health professional supervised
23 exercise may facilitate safe access to physical activity for those at risk of falls or cardiac events.
24 Preliminary evidence has found telehealth rehabilitation for improving motor function in stroke is
25 at least as effective as its centre-based equivalent³⁵. However, the safety and efficacy of supervised
26 exercise training for the reduction of secondary stroke risk factors (including aerobic and
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3 resistance training) delivered via telehealth and measures required to optimise its safety remains
4 largely unexplored³⁵.
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10 Our scoping review will map the available evidence surrounding supervised exercise delivered via
11 telehealth in chronic conditions. This will provide an understanding of current evidence to inform
12 clinical trials in stroke. Our specific research questions are:
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16 With regards to interventions involving supervised exercise delivered via telehealth:
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- 19 1. What population groups have been included in the research?
- 20 2. What are the key characteristics of the interventions delivered (including frequency,
21 duration and intensity of exercise sessions, length of programs, types of exercise included,
22 telehealth modalities used)?
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- 28 3. What are health professionals', participants' and carers' experiences of, or attitudes
29 towards telehealth-supervised exercise interventions?
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- 33 4. What strategies have been used to optimise safety, feasibility, delivery and adherence?
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- 36 5. What are the barriers and limitations to these interventions and what strategies have been
37 used to mitigate these?
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- 40 6. What is the effectiveness and cost-effectiveness of telehealth-supervised exercise sessions for
41 reducing secondary stroke risk factors?
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49 **Methods and analysis:**

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51 Scoping reviews enable the mapping of research findings and identification of gaps in research
52 evidence while providing a source of knowledge translation³⁶⁻³⁸. We have chosen the scoping
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3 review method to evaluate the evidence surrounding supervised exercise delivered via telehealth in
4 chronic conditions because scoping reviews are suited to areas of research where outcomes are not
5 well established³⁷ or are heterogeneous in nature³⁸. We will use the framework of scoping reviews
6 first described by Arksey and O'Malley (2005)³⁶ which requires *identifying the research question;*
7 *identifying relevant studies; study selection; charting of the data; and collating, summarizing and*
8 *reporting the results.* The refinements to the Arksey and O'Malley (2005)³⁶ framework suggested
9 by Levac, et al. (2010)³⁷ and Peters, et al. (2015)³⁹ will also be considered to optimise transparency
10 and methodological rigor.

11 To optimise reporting this scoping review protocol uses the Preferred Reporting Items for
12 Systematic Review and Meta-analysis Protocols (PRISMA-P) method⁴⁰. Where items in the
13 PRISMA-P are not relevant to scoping reviews, we have adapted the items with reference to the
14 Preferred Reporting Items for Systematic Review and Meta-analysis extension for Scoping
15 Reviews (PRISMA-ScR)³⁸.

16 ***Identifying the research question***

17 The six research questions of our review are identified in the introduction of this paper. These
18 questions will inform future research into supervised exercise in stroke survivors by mapping and
19 identifying gaps in the available evidence regarding supervised exercise delivered via telehealth in
20 chronic conditions.

21 We define the key terms of the scoping review's questions as follows:

- 22 - *Supervision:* real-time monitoring (visual, or through other continuous physiologic
23 monitoring such as echocardiogram or heart rate) by a health professional with the

opportunity for participants to receive and provide health professionals feedback in real time to ensure the exercise is being carried out safely and correctly.

- *Exercise*: our review will consider exercise as physical activity targeted at reducing outcomes that impact cardiovascular disease (and secondary stroke) risk factors, including hypertension, hyperlipidemia, dysglycemia or daily physical activity. To ensure our review captures all evidence relating to the research question regarding the safety of supervised exercise delivered via telehealth and its implications for falls risk, the definition of exercise will also include any intervention involving lower limb weight bearing, for example balance training.
- *Telehealth*: The application of telecommunications and virtual technology to provide health care outside of conventional health-care facilities (WHO, 2018)¹⁸.

Identifying relevant studies

Studies will be included in the review if they meet the eligibility requirements set out in Box 1. All published primary research studies will be included in the review. In order to accurately capture current approaches to real-time supervised exercise delivered via telehealth in this rapidly evolving field, we will also include published trial protocols and abstracts of unpublished studies for which authors can be contacted to provide sufficient information.

Box 1

	Inclusion	Exclusion
Population	Chronic health condition 18 years and older	Healthy subjects (including those with a BMI less than 30)
Intervention	Supervised exercise delivered via telehealth where: - The majority of supervised exercise	Exercise delivered to participants located onsite at a health-care facility Exercise occurring with a health

	<p>is delivered via telehealth and this supervision involves observation in real-time (visual, or via other continuous physiologic monitoring)</p> <ul style="list-style-type: none"> - The exercise sessions provide opportunity for participant and health professional feedback to ensure exercises are carried out correctly and safely - Exercise that impacts or is intended to impact cardiovascular disease risk or involves lower limb weight bearing 	<p>professional present at the participant's site (eg expert remotely supervising novice health professional on telehealth)</p> <p>Exercise not supervised by a health professional</p>
Comparison	Any	Nil exclusion criteria
Outcome	All	Nil exclusion criteria
Publication Type	<p>Published primary research studies, including both qualitative and quantitative research</p> <p>Primary research protocols which have been published</p> <p>Abstracts of unpublished studies for which authors can be contacted and provide sufficient information to enable accurate analysis</p>	<p>Text</p> <p>Opinion papers</p> <p>Letters</p> <p>Literature reviews</p> <p>Systematic reviews</p> <p>Meta-analyses</p> <p>Not published in English</p>

Study Selection

We will conduct a comprehensive, systematic search of Medline, CINAHL, Scopus, Cochrane, Pedro and Embase databases. The search strategy will be developed in consultation with a senior research librarian and will include use of the relevant index terms and key words for 'exercise' and 'telehealth'. We will hand search the reference lists of all included studies as well as relevant systematic reviews. Experts in the field will also be contacted to identify any other pertinent

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3 research. We will contact authors of abstracts of unpublished studies retrieved and request they
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5 provide information to enable accurate analysis of their research.
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10 Full details of the databases' draft search strategies are shown in Appendix 1.
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14 Studies identified through the search strategy will be exported from each database to EndNote
15 X8.2 and then exported to Covidence for removal of duplicates and screening of titles and
16
17 abstracts. All titles and abstracts will be independently reviewed by two authors and conflicts will
18
19 be resolved by a third author. To optimise the reliability of screening of titles and abstracts all
20
21 authors will participate in the screening of the initial 150 studies for inclusion using the selection
22
23 criteria (outlined in Box 1). The authors will then then meet to resolve any issues or ambiguities
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25 found in the criteria. Following title and abstract screening, full texts of potentially relevant studies
26
27 will be assessed for eligibility by two authors independently, with any discrepancies resolved by a
28
29 third author. To support the inherently iterative nature of scoping reviews³⁶⁻³⁹ authors will meet
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31 regularly to discuss the selection process. Any refinements made to the selection criteria will be
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33 recorded. The selection process will be reported using a PRISMA 2009 Flow diagram⁴¹.
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42 ***Data charting***

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44 Data charting is the method used for extracting data in scoping reviews^{36 38}. It allows researchers to
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46 capture a breadth of information including detail on processes to provide further context to the
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48 research outcomes³⁶. We will use a standardized electronic form to chart the data developed by the
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50 authors. All authors will pilot data charting with the initial 5 studies and will then meet to discuss
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52 and resolve any issues or discrepancies that arise. This process will also facilitate the reliability of
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3 the data charting. The remainder of the data will be charted by one author and checked by a second
4 author. Any discrepancies will be resolved by a third author. The iterative nature of scoping
5 reviews means the data charting form may require adaptation during the data charting process³⁶⁻³⁹.
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8 Regular communication between authors will occur to identify, in a timely manner, any need for
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To avoid inclusion of duplicate data we will identify and group multiple publications relating to
the one research project prior to the charting of the data. The study details and outcomes chosen for
charting are guided by The Cochrane Collaboration's *Checklist of items to consider in data
collection or data extraction*⁴² and the recommendation of Arskey and O'Malley (2005)³⁶. Where
available these will include, but are not limited to: bibliographic information; study aims/purpose;
research design; number of participants; duration of intervention and follow-up; date; setting;
country; co-morbidity, socio-demographics; and specific category of chronic condition. Where
available the intervention data extracted will include frequency, intensity, time and type of exercise
intervention and any control or comparison groups; the number of intervention groups; the type of
telehealth modality used; adherence; satisfaction; and other methods of exercise delivery or
support used in the study. All reported outcome measurements will be charted. Details of outcomes
which directly inform the research questions including economic viability, intervention feasibility,
intervention safety (including adverse events), cardiovascular risk factor indicators (including
blood pressure, level of physical activity, cholesterol, lipid profiles, insulin resistance) will be
prioritised. Any other key findings or recommendations not captured through the above process
which specifically relate to our research questions will also be charted.

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3 We will use *The Cochrane Collaboration's tool for assessing risk of bias*⁴² to assess the bias of
4 each individual, quantitative study. We will use the *Consolidated Criteria for Reporting*
5 *Qualitative Research* (COREQ) checklist⁴³ and the *Mixed Methods Appraisal Tool (MMAT) –*
6 *Version 2011*^{44 45} to individually assess qualitative and mixed methods studies for methodological
7 rigor respectively. This critical appraisal will be carried out by two independent authors who will
8 meet to discuss and resolve any discrepancies found in their assessments, with adjudication by a
9 third author if necessary.
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22 ***Collating summarising and reporting of results***

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24 Our scoping review will be reported using the PRISMA-ScR³⁸. The results will be summarised and
25 reported to prioritise the findings relevant to the specific research questions. Quantitative data and
26 the results of individual studies' critical appraisal will be presented in tabular format. Qualitative
27 data will be analysed thematically and collated concisely into a tabular format. If needed, further
28 narrative description will be provided to aid interpretation of the results. Visual or diagrammatic
29 representation of data will occur to aid its summary or conceptualization as needed.
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40 To aid the synthesis of the results we will provide a narrative summary of the findings most
41 pertinent to the review's research questions. Knowledge gaps in the research evidence and their
42 implications will also be recognized through a narrative summary. Our key findings, informed by
43 the critical appraisal of individual studies will be used to make recommendations for future
44 research and practice relating to supervised exercise delivered via telehealth. Limitations of the
45 scoping review will also be acknowledged.
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Ethics and dissemination:

The findings of our scoping review will be disseminated through presentation at appropriate forums or conferences. The completed scoping review will also be submitted for publication in a peer reviewed journal and form part of a PhD thesis. Findings will be directly translated to inform the development of a supervised exercise program delivered via telehealth that will be pilot tested and evaluated in terms of effect on reducing secondary stroke risk factors. We will use only secondary de-identified data in the scoping review, therefore ethics approval is not required.

Discussion

The high mortality rates and the significant burden of disease resulting from secondary stroke must be addressed. Our review will explore emerging research in relation to the efficacy, acceptability, safety, economics and feasibility of supervised exercise delivered via telehealth. This research has the potential to provide strategies to overcome current barriers in the translation of evidence for physical activity in stroke survivors to reduce stroke recurrence.

This review will significantly contribute to the knowledge base of exercise and rehabilitation delivered via telehealth. The breadth of research captured means it has implications beyond stroke care to broadly inform the application of supervised exercise and rehabilitation via telehealth. It is anticipated that our findings will be relevant to researchers, healthcare workers and policy makers at a national and international level.

Author Statement:

All authors made significant intellectual contributions to the protocol. CE conceived the idea for the scoping review. ERR (guarantor) and CE conceptualised and drafted the research questions and study selection criteria, while CMS, EAL, NAF and AP contributed to their further development. ERR developed the study methodology with EAL, CMS, NAF, AP and CE providing feedback for refinement. All authors contributed to the drafting and editing, and approved the final manuscript.

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Appendix 1: DRAFT search strategy

Medline

- #1 exp Telemedicine/
 #2 exp VIDEOCONFERENCING/
 #3 exp Remote Consultation/
 #4 (ehealth* or e-health* or e health* or electronic-health* or electronic health* or mhealth* or m-health* or m health* or mobile health* or mobile-health* or emedic* or e-medic* or e medic* or electronic-medic* or electronic-medic*).mp.
 #5 (videoconferenc* or video-conferenc* or video conferenc* or teleconsult* or teleconsult* or tele consult* or teleconferenc* or tele-conferenc* or tele conferenc* or videoconsult* or video-consult* or video consult*).mp.
 #6 (interactive adj ((health adj communicat*) or video* or technolog* or multimedia)).mp.
 #7 ((digital health or digital) adj intervention*).mp.
 #8 (telehealth* or tele-health* or tele health or telemedic* or tele-medic* or telemedic* or telerehab* or tele-rehab* or tele rehab* or teleconsult* or teleconsult* or tele consult* or telemonitor* or tele-monitor* or tele monitor*).mp.
 #9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
 #10 exp EXERCISE/
 #11 exp Exercise Therapy/
 #12 exp REHABILITATION/
 #13 (physiotherap* or physical therap* or physical activ* or physical train* or physical condition* or exercis* or rehab* or exercise therap* or exercise train*).mp.
 #14 10 or 11 or 12 or 13
 #15 9 and 14

CINAHL

- S13 S11 AND S12
 S12 S1 OR S2 OR S3
 S11 S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10

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2
3 S10 ((digital health or digital) adj intervention*)
4
5 S9 (interactive adj ((health adj communicat*) or video* or technolog* or
6 multimedia))
7
8 "videoconferenc*" or "video-conferenc*" or "video conferenc*" or "teleconsult*"
9 S8 or "tele-consult*" or "tele consult*" or "teleconferenc*" or "tele-conferenc*" or
10 "tele conferenc*" or "videoconsult*" or "video-consult*" or "video consult*"
11
12 "ehealth*" or "e-health*" or "e health*" or "electronic-health*" or "electronic
13 health*" or "mhealth*" or "m-health*" or "m health*" or "mobile health*" or
14 S7 "mobile-health*" or "emedic*" or "e-medic*" or "e medic*" or "electronic-
15 medic*" or "electronic-medic*"
16
17 "telehealth*" or "tele-health*" or "tele health" or "telemedic*" or "tele-medic*"
18 S6 or "telemedic*" or "telerehab*" or "tele-rehab*" or "tele rehab*" or "teleconsult*"
19 or "tele-consult*" or "tele consult*" or "telemonitor*" or "tele-monitor*" or "tele
20 monitor*"
21
22 S5 (MH "Videoconferencing+")
23
24 S4 (MH "Telehealth+")
25
26 "physiotherap*" or "physical therap*" or "physical activ*" or "physical train*" or
27 S3 "physical condition*" or "exercis*" or "rehab*" or "exercise therap*" or "exercise
28 train*"
29
30 S2 (MH "Rehabilitation+")
31
32 S1 (MH "Exercise+")
33
34

35 Cochrane

- 36
37 #1 MeSH descriptor: [Telemedicine] explode all trees
38
39 #2 MeSH descriptor: [Videoconferencing] this term only
40
41 #3 "videoconference" or "video-conference" or "video conference" or "teleconsultation" or
42 "tele-consultation" or "tele consultation" or "teleconference" or "tele-conference" or "tele
43 conference" or "videoconsultation" or "video-consultation" or "video consultation"
44
45 #4 "ehealth" or "e-health" or "e health" or "electronic-health" or "electronic health" or
46 "mhealth" or "m-health" or "m health" or "mobile health" or "mobile-health" or
47 "emedicine" or "e-medicine" or "e medicine" or "electronic-medicine" or "electronic-
48 medicine"
49
50 #5 "telehealth" or "tele-health" or "tele health" or "telemedicine" or "tele-medicine" or
51 "telemedicine" or "telerehabilitation" or "tele-rehabilitation" or "tele rehabilitation" or
52 "teleconsultation" or "tele-consultation" or "tele consultation" or "telemonitor" or "tele-
53 monitor" or "tele monitor"
54
55 #6 "digital health intervention" or "digital intervention"
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3 #7 "interactive video" or "interactive technology" or "interactive multimedia" or "interactive health"
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6 #8 #1 or #2 or #3 or #4 or #5 or #6 or #7
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8 #9 MeSH descriptor: [Exercise] explode all trees
9
10 #10 MeSH descriptor: [Rehabilitation] explode all trees
11
12 #11 "physiotherapy" or "physical therapy" or "physical activity" or "physical training" or
13 "physical conditioning" or "exercise" or "rehabilitation" or "rehab" or "exercise therapy"
14
15 #12 #9 or #10 or #11
16
17 # 13 #12 and #8
18

Embase

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20 #1 exp exercise/
21
22 #2 exp kinesiotherapy/
23
24 #3 exp rehabilitation patient/ or exp rehabilitation medicine/ or exp rehabilitation/ or exp
25 stroke rehabilitation/ or exp athletic rehabilitation/ or exp pulmonary rehabilitation/ or exp
26 community based rehabilitation/ or exp geriatric rehabilitation/ or exp rehabilitation
27 center/ or exp heart rehabilitation/ or exp cancer rehabilitation/ or exp rehabilitation care/
28 or exp rehabilitation nursing/
29
30
31 #4 (physiotherap* or physical therap* or physical activ* or physical train* or physical
32 condition* or exercis* or rehab* or exercise therap* or exercise train*).mp.
33
34 #5 1 or 2 or 3 or 4
35
36 #6 exp telehealth/ or telemedicine/ or exp telerehabilitation/ or exp telemonitoring/ or exp
37 teleconsultation/ or exp videoconferencing/
38
39 #7 (ehealth* or e-health* or e health* or electronic-health* or electronic health* or mhealth*
40 or m-health* or m health* or mobile health* or mobile-health* or emedic* or e-medic* or
41 e medic* or electronic-medic* or electronic-medic*).mp.
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44 #8 (videoconferenc* or video-conferenc* or video conferenc* or teleconsult* or tele-consult*
45 or tele consult* or teleconferenc* or tele-conferenc* or tele conferenc* or videoconsult*
46 or video-consult* or video consult*).mp.
47
48 #9 (telehealth* or tele-health* or tele health or telemedic* or tele-medic* or telemedic* or
49 telerehab* or tele-rehab* or tele rehab* or teleconsult* or tele-consult* or tele consult* or
50 telemonitor* or tele-monitor* or tele monitor*).mp.
51
52 #10 ((digital health or digital) adj intervention*).mp.
53
54 #11 (interactive adj ((health adj communicat*) or video* or technolog* or multimedia)).mp.
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3 #12 6 or 7 or 8 or 9 or 10 or 11
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5 #13 5 and 12
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8 9 **Scopus**

10 ((TITLE-ABS-KEY ("videoconference" OR "video-conference" OR "video
11 conference" OR "teleconsultation" OR "tele-consultation" OR "tele
12 consultation" OR "teleconference" OR "tele-conference" OR "tele
13 conference")) OR (TITLE-ABS-KEY ("videoconsultation" OR "video-
14 consultation" OR "video consultation" OR "ehealth" OR "e-health" OR "e
15 health" OR "electronic-health" OR "electronic health" OR "mhealth" OR "m-
16 health" OR "m health" OR "mobile health" OR "mobile-health")) OR (TITLE-
17 ABS-KEY ("emedicine" OR "e-medicine" OR "e medicine" OR "electronic-
18 medicine" OR "electronic-medicine" OR "telehealth" OR "tele-health" OR "tele
19 health")) OR (TITLE-ABS-KEY ("telemedicine" OR "tele-
20 medicine" OR "telemedicine" OR "telerehabilitation" OR "tele-
21 rehabilitation" OR "tele rehabilitation" OR "teleconsultation" OR "tele-
22 consultation" OR "tele consultation" OR "telemonitor" OR "tele-monitor" OR "tele
23 monitor")) OR (TITLE-ABS-KEY ("digital health intervention" OR "digital
24 intervention")) OR (TITLE-ABS-KEY ("interactive video" OR "interactive
25 technology" OR "interactive multimedia" OR "interactive
26 health"))) AND (TITLE-ABS-KEY ("physiotherapy" OR "physical
27 therapy" OR "physical activity" OR "physical training" OR "physical
28 conditioning" OR "exercise" OR "rehabilitation" OR "rehab" OR "exercise
29 therapy" OR "exercise training")))
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35 36 **Pedro**

37 Telerehab* exercis*
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BMJ Open

Supervised exercise delivered via telehealth in real-time to manage chronic conditions in adults: A protocol for a scoping review to inform future research in stroke survivors

Journal:	<i>BMJ Open</i>
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Primary Subject Heading:	Neurology
Secondary Subject Heading:	Cardiovascular medicine, Rehabilitation medicine, Sports and exercise medicine
Keywords:	Telehealth, Telerehabilitation, Supervised exercise, Physical activity, Secondary stroke, Stroke < NEUROLOGY

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3 1 **Title:** Supervised exercise delivered via telehealth in real-time to manage chronic conditions
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5 2 in adults: A protocol for a scoping review to inform future research in stroke survivors
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7
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9
10 4 **Authors:**

- 11
12 5 1. Emily R. Ramage, BPhysio (Hons),
13
14 PhD Candidate, School of Health Sciences, University of Newcastle, Australia,
15 6
16 Department of Physiotherapy, Western Health, St Albans, Australia
17 7
18 Centre for Research Excellence in Stroke Recovery and Rehabilitation, Florey Institute
19 8
20 of Neuroscience and Hunter Medical Research Institute, Australia
21
22 Email: emily.ramage@uon.edu.au Twitter: @EmilyRRamage
23
24 10
25
26 11 2. Natalie A. Fini, BPhysio (Hons), Grad Dip Rehab,
27
28 PhD Candidate, La Trobe University, Bundoora, Australia
29 12
30 Lecturer, Department of Physiotherapy, Melbourne School of Health Sciences,
31 13
32 the University of Melbourne, Australia
33 14
34 Email: natalie.fini@unimelb.edu.au Twitter: @NatFiniPhysio
35 15
36
37 16 3. Elizabeth A. Lynch, PhD
38
39 Research Fellow, Adelaide Nursing School, University of Adelaide
40 17
41
42 Email: elizabeth.lynch@adelaide.edu.au Twitter: @E_A_Lynch
43 18
44
45 19 4. Amanda Patterson, M Nutr & Diet, PhD
46
47 20 Senior Lecturer, School of Health Sciences and Priority Research Centre for Stroke and
48
49 Brain Injury, University of Newcastle, Australia
50 21
51
52 Email: amanda.patterson@newcastle.edu.au
53 22
54
55 23 5. Catherine M. Said, PhD
56
57 24 Associate Professor Physiotherapy, Western Health, St Albans, Australia
58
59 25 Physiotherapy, University of Melbourne, Parkville, Australia
60

26 Australian Institute for Musculoskeletal Science, St Albans, Australia

27 Phone +61 3 8395 8106, email csaid@unimelb.edu.au; Twitter @cathy_said

28 6. Coralie English, PhD

29 Associate Professor, School of Health Sciences and Priority Research Centre for Stroke
30 and Brain Injury, University of Newcastle, Callaghan, Australia

31 Centre for Research Excellence in Stroke Recovery and Rehabilitation, Florey Institute
32 of Neuroscience and Hunter Medical Research Institute, Australia

33 Phone: +61 2 4913 8102 E-mail: Coralie.english@newcastle.edu.au Twitter:
34 @Coralie_English

36 **Correspondence (for review):**

Name	Emily Ramage
Department	School of Health Sciences
Institution	University of Newcastle
Country	Australia
Tel	+61 408 669 204
Mob	+61 408 669 204
Fax	
Email	emily.ramage@uon.edu.au

38 **Correspondence (for publication)**

Name	Emily Ramage
Department	School of Health Sciences
Institution	University of Newcastle
Address	University Drive, Callaghan, NSW, 2308, Australia

Email	emily.ramage@uon.edu.au
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39

40 **Abbreviated title:** Supervised exercise delivered via telehealth: A scoping review protocol

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42 **Key words:** Telehealth, telerehabilitation, supervised exercise, stroke, physical
43 activity, secondary stroke, stroke recurrence

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46 2667 (Strengths and Limitations; Introduction; Methods and Analysis;
47 Ethics and Dissemination; Discussion)

48 **References:** 48

49 **Box:** 1

50 **Tables:** Nil

51 **Figures:** Nil

52 **Appendices:** 2

53 **Ethics approval:** The review will utilise only secondary de-identified data and therefore
54 ethics approval is not required

55

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11
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13
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15 67 EAL reports support from the National Health and Medical Research Council.
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3 69 **ABSTRACT**
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8 71 **Introduction:** Increasing physical activity reduces secondary stroke risk factors, but many
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10 72 stroke survivors have low levels of physical activity. Supervised exercise delivered via
11
12 73 telehealth has the potential to overcome barriers to increased physical activity in stroke
13
14 74 survivors. Our scoping review will examine the emerging field of supervised exercise delivered
15
16 75 via telehealth to map the available evidence in relation to its efficacy, acceptability, safety and
17
18 76 feasibility in chronic conditions to inform future research into its ability to increase physical
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20 77 activity.
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26 79 **Methods and analysis:** The methodological framework of Arksey and O'Malley will be
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28 80 applied to our scoping review. A systematic search of Medline, CINAHL, Scopus, Cochrane,
29
30 81 Pedro and Embase; hand searching of pertinent studies' reference lists; and consultation with
31
32 82 experts in the field will identify relevant papers. Studies involving participants with a chronic
33
34 83 condition who undertake supervised exercise delivered by a health professional via telehealth
35
36 84 targeted at improving secondary stroke risk factors or involving lower limb weight bearing
37
38 85 exercise will be included. Study selection and critical appraisal of individual studies will be
39
40 86 carried out independently by two authors with discrepancies resolved by a third author.
41
42 87 Quantitative and qualitative data will be charted using a standardized form. Results will be
43
44 88 tabulated and narratively summarized to highlight findings relevant to the review's research
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46 89 questions and to inform recommendations for future research.
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54 91 **Ethics and dissemination:** Our review will significantly contribute to the knowledge base of
55
56 92 exercise and rehabilitation delivered via telehealth and its application in chronic conditions,
57
58 93 including stroke. Findings will be relevant to researchers, healthcare workers and policy makers
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3 94 and will be disseminated through publication and presentations. Only secondary de-identified
4
5 95 data will be included, therefore ethics approval will not be sought.
6

7
8 96 This protocol is not registered as PROSPERO currently excludes scoping reviews.
9

10 97 *Keywords:* Telehealth, telerehabilitation, supervised exercise, stroke, physical activity,
11
12 98 secondary stroke
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3 100 **Strengths and limitations of this study:**
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- 5 101 • Our comprehensive scoping review will bring together research findings regarding
6 102 supervised exercise delivered via telehealth to inform its future application to research
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8 103 and practice across chronic conditions
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11
12 104 • The inclusion of all research study designs will ensure the breadth of evidence
13
14 regarding supervised exercise delivered via telehealth is captured
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17 106 • We will use a published framework to optimise transparency and methodological rigour
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20 107 • To facilitate accurate analysis of the evidence and its role in informing future research,
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22 108 quantitative studies will be individually assessed for bias and qualitative studies will be
23
24 109 individually assessed for methodological rigour
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26 110 • A limitation of this review will be the exclusion of unpublished literature for which
27
28 authors are unable to provide sufficient additional information, and research not
29 111 published in English.
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114 **Introduction**

115 Stroke is the second leading cause of death and burden of disease worldwide^{1 2}. The number of
116 people experiencing stroke is increasing, with estimates predicting 70 million stroke survivors
117 and 12 million stroke related deaths worldwide in 2030³. Secondary prevention of stroke is
118 currently inadequate with incidence rates as high as 40%⁴. Secondary strokes tend to be more
119 severe with a mortality rate nearly double that of first stroke⁵. Effective secondary prevention
120 strategies must be significantly improved to prevent the impact of stroke recurrence.

121
122 Lifestyle interventions which involve increasing physical activity in stroke survivors can
123 improve secondary stroke risk factors^{6 7}. Despite this, stroke survivors frequently have low
124 activity levels⁸⁻¹⁰. Simply providing prompts and encouragement is not sufficient to achieve
125 increases in physical activity in stroke survivors⁹. The potential importance that *supervision of*
126 exercise plays in increasing physical activity in stroke survivors is emerging in the evidence.
127 Research has found supervised exercise is superior to unsupervised exercise in increasing long-
128 term physical activity levels in stroke survivors¹¹. Furthermore, stroke survivors have identified
129 support provided by qualified staff during supervised exercise was a key facilitator for
130 increasing physical activity¹². Supervised exercise can also improve walking ability¹³,
131 mobility¹⁴, balance¹⁴ and endurance¹⁴ in stroke survivors; all key elements of physical function
132 which are positively associated with physical activity levels in this population¹⁵.

133
134 Barriers to physical activity identified by stroke survivors include transport^{16 17}, economic
135 constraints¹⁶, distance¹⁷ and a perceived lack of appropriate services¹⁶. Marzolini, et al. (2016)
136 found barriers to physical activity identified in their study also increased with increased
137 socioeconomic disadvantage¹⁷. Telehealth uses “telecommunications and virtual technology to
138 deliver health care outside of traditional health-care facilities”¹⁸. This rapidly evolving mode of

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3 139 service delivery has significant potential to improve equity of service delivery and overcome
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5 140 barriers such as access, distance, cost and transport. Evidence is emerging across chronic
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7 141 conditions regarding the application of supervised exercise delivered via telehealth¹⁹⁻²⁴.
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10 142 Preliminary research indicates these interventions may be feasible²¹, improve self-efficacy²⁰
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12 143 and reduce costs of exercise program delivery²⁴.
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16
17 145 Stroke related impairment may impact the safety and efficacy of supervised exercise delivered
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19 146 via telehealth to reduce secondary stroke risk factors. Stroke survivors are commonly affected
20
21 147 by impaired cognition²⁵, physical ability^{26 27} and post stroke fatigue²⁸. Internationally, the
22
23 148 potential for supervised exercise to optimise stroke survivor safety is recognised. The
24
25 149 *American Physical activity and exercise recommendations for stroke survivors*²⁹ and the
26
27 150 *Canadian stroke best practice recommendations: Secondary prevention of stroke*³⁰ suggest the
28
29 151 consideration of health professional supervised exercise where co-morbidity^{29 30}, falls risk³⁰ and
30
31 152 level of disability²⁹ present a risk. Seventy-nine percent of stroke survivors are reported to have
32
33 153 at least one cardiovascular co-morbidity, while over a quarter have at least two³¹. Falls are
34
35 154 common post stroke³²⁻³⁴ and 45% of community dwelling stroke survivors have been found to
36
37 155 fall at least once in a twelve month period³⁴. Supervised exercise delivered via telehealth may
38
39 156 provide a safe and accessible way to increase physical activity for stroke survivors at risk of
40
41 157 falls or cardiac events. Preliminary evidence has found telehealth rehabilitation for improving
42
43 158 motor function in stroke is at least as effective as its centre-based equivalent³⁵. However, the
44
45 159 safety and efficacy of supervised exercise training for the reduction of secondary stroke risk
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47 160 factors (including aerobic and resistance training) delivered via telehealth remains largely
48
49 161 unexplored³⁵.
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3 163 Focusing on supervised exercise due to its significant potential to support increased physical
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5 164 activity in stroke survivors, our scoping review will map the available evidence surrounding
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7 165 supervised exercise delivered via telehealth in chronic conditions. This will provide an
8
9 166 understanding of current evidence to inform clinical trials in stroke. Our specific research
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11 167 questions are:

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14 168 With regards to interventions involving supervised exercise delivered via telehealth in chronic
15
16 169 conditions:

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19 170 1. What population groups have been included in the research and what are the key
20
21 171 characteristics of the interventions delivered (including: frequency, duration and
22
23 172 intensity; types of exercise included; and telehealth modalities used)?
- 24
25
26 173 2. What are health professionals', participants' and carers' experiences of, or attitudes
27
28 174 towards, supervised exercise delivered via telehealth?
- 29
30
31 175 3. What strategies have been used to optimise safety, feasibility, delivery and adherence?
- 32
33 176 4. What are the barriers and limitations to these interventions and what strategies have
34
35 177 been used to mitigate these?
- 36
37
38 178 5. What is the effectiveness and cost-effectiveness of telehealth-supervised exercise sessions
39
40 179 for reducing secondary stroke risk factors?

41 42 43 44 181 **Methods and analysis:**

45
46
47 182 Scoping reviews enable the mapping of research findings and identification of gaps in research
48
49 183 evidence while providing a source of knowledge translation³⁶⁻³⁸. We have chosen the scoping
50
51 184 review method to evaluate the evidence surrounding supervised exercise delivered via
52
53 185 telehealth in chronic conditions because scoping reviews are suited to areas of research where
54
55 186 outcomes are not well established³⁷ or are heterogeneous in nature³⁸. We will use the
56
57 187 framework of scoping reviews first described by Arksey and O'Malley (2005)³⁶ which requires
58
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1
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3 188 *identifying the research question; identifying relevant studies; study selection; charting of the*
4
5 189 *data; and collating, summarizing and reporting the results.* The refinements to the Arksey and
6
7
8 190 O'Malley (2005)³⁶ framework suggested by Levac, et al. (2010)³⁷ and Peters, et al. (2015)³⁹
9
10 191 will also be considered to optimise transparency and methodological rigour.
11
12 192 To optimise reporting this scoping review protocol uses the Preferred Reporting Items for
13
14 193 Systematic Review and Meta-analysis Protocols (PRISMA-P)^{40 41} method (Appendix 1). Where
15
16 194 items in the PRISMA-P are not relevant to scoping reviews, we have adapted the items with
17
18 195 reference to the Preferred Reporting Items for Systematic Review and Meta-analysis extension
19
20 196 for Scoping Reviews (PRISMA-ScR)³⁸. Our scoping review was initiated on September 1st
21
22 197 2018 and is to be completed by May 30th 2019.
23
24
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26 198

199 ***Identifying the research question***

200 The five research questions of our review are identified in the introduction of this paper. These
201 questions will inform future research into supervised exercise in stroke survivors by mapping
202 and identifying gaps in the available evidence regarding supervised exercise delivered via
203 telehealth in chronic conditions.

204
205 We define the key terms of the scoping review's questions as follows:

- 206 - *Supervision*: real-time monitoring (visual, or through other continuous physiologic
207 monitoring such as echocardiogram or heart rate) by a health professional with the
208 opportunity for participants to receive and provide health professionals feedback in real
209 time to ensure the exercise is being carried out safely and correctly.
- 210 - *Exercise*: our review will consider exercise as physical activity targeted at reducing
211 outcomes that impact cardiovascular disease (and secondary stroke) risk factors,
212 including hypertension, hyperlipidemia, dysglycemia or daily physical activity. To

213 ensure our review captures all evidence relating to the research question regarding the
 214 safety of supervised exercise delivered via telehealth and its implications for falls risk,
 215 the definition of exercise will also include any intervention involving lower limb weight
 216 bearing, for example balance training.

217 - *Telehealth*: The application of telecommunications and virtual technology to provide
 218 health care outside of conventional health-care facilities (WHO, 2018)¹⁸.

220 **Identifying relevant studies**

221 Studies will be included in the review if they meet the eligibility requirements set out in Box 1.

222 All published primary research studies will be included in the review. The exclusion criteria
 223 includes otherwise healthy participants with a BMI < 30 to ensure a consistent definition of the
 224 chronic condition *obesity* as a BMI of 30 or greater⁴². In order to accurately capture current
 225 approaches to real-time supervised exercise delivered via telehealth in this rapidly evolving
 226 field, we will also include published trial protocols and abstracts of unpublished studies for
 227 which authors can be contacted to provide sufficient information. Studies included in the
 228 scoping review will not be limited by year of publication.

229 Box 1

	Inclusion	Exclusion
Population	Chronic health condition Adult, 18 years and older	Healthy participants (including those with a BMI less than 30)
Intervention	Supervised exercise delivered via telehealth where: - The majority of supervised exercise is delivered via telehealth and this supervision involves observation in real-time (visual, or via other continuous physiologic monitoring) - The exercise sessions provide opportunity for participant and	Exercise delivered to participants located onsite at a health-care facility Exercise occurring with a health professional present at the participant's site (e.g. expert remotely supervising novice health professional on telehealth) Exercise not supervised by a health professional

	health professional feedback to ensure exercises are carried out correctly and safely - Exercise that impacts or is intended to impact cardiovascular disease risk or involves lower limb weight bearing	
Comparison	Any	Nil exclusion criteria
Outcome	All	Nil exclusion criteria
Publication Type	Published primary research studies, including both qualitative and quantitative research Primary research protocols which have been published Abstracts of unpublished studies for which authors can be contacted and provide sufficient information to enable accurate analysis	Text Opinion papers Letters Literature reviews Systematic reviews Meta-analyses Not published in English

230

231 ***Study Selection***

232 We will conduct a comprehensive, systematic search of Medline, CINAHL, Scopus, Cochrane,
233 Pedro and Embase databases. The search strategy will be developed in consultation with a
234 senior research librarian and will include use of the relevant index terms and key words for
235 'exercise' and 'telehealth'. We will hand search the reference lists of all included studies as
236 well as relevant systematic reviews. Experts in the field will be contacted to identify any other
237 pertinent research. We will contact authors of abstracts of unpublished studies retrieved and
238 request they provide information to enable accurate analysis of their research.

239

240 Full details of the databases' draft search strategies are shown in Appendix 2.

241

242 Studies identified through the search strategy will be exported from each database to EndNote
243 X8.2 and then exported to Covidence for removal of duplicates and screening of titles and

1
2
3 244 abstracts. Covidence will be used to manage data throughout the remainder of the review. All
4
5 245 titles and abstracts will be independently reviewed by two authors and conflicts will be
6
7
8 246 resolved by a third author. To optimise the reliability of screening of titles and abstracts all
9
10 247 authors will participate in the screening of the initial 150 studies for inclusion using the
11
12 248 selection criteria (outlined in Box 1). The authors will then then meet to resolve any issues or
13
14 249 ambiguities found in the criteria. Following title and abstract screening, full texts of potentially
15
16 250 relevant studies will be assessed for eligibility by two authors independently, with any
17
18 251 discrepancies resolved by a third author. To support the inherently iterative nature of scoping
19
20 252 reviews³⁶⁻³⁹, authors will communicate regularly to discuss the selection process. Any
21
22 253 refinements made to the selection criteria will be recorded. The selection process will be
23
24 254 reported using a PRISMA 2009 Flow diagram⁴³.
25
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31 ***Data charting***

32
33 257 Data charting is the method used for extracting data in scoping reviews^{36 38}. It allows
34
35 258 researchers to capture a breadth of information including detail on processes to provide further
36
37 259 context to the research outcomes³⁶. We will develop a standardised electronic form to chart the
38
39 260 data. All authors will pilot the data charting form with the initial five studies to ensure the data
40
41 261 extracted optimally addresses the research questions³⁷ and then meet to discuss and resolve any
42
43 262 issues identified. This process will also facilitate the reliability of the data charting. The
44
45 263 remainder of the data will be charted by one author and checked by a second author. Any
46
47 264 discrepancies will be resolved by a third author. The iterative nature of scoping reviews means
48
49 265 the data charting form may require adaptation during the data charting process³⁶⁻³⁹. Regular
50
51 266 communication between authors will occur to identify, in a timely manner, any need for
52
53 267 modification to the data charting form. All significant alterations to the data chart will be
54
55 268 recorded.
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6 270 To avoid inclusion of duplicate data we will identify and group multiple publications relating to
7
8 271 the one research project prior to the charting of the data. The study details and outcomes chosen
9
10 272 for charting are guided by The Cochrane Collaboration's *Checklist of items to consider in data*
11
12 273 *collection or data extraction*⁴⁴ and the recommendation of Arksey and O'Malley (2005)³⁶.
13
14 274 Where available these will include, but are not limited to: bibliographic information; study
15
16 275 aims/purpose; research design; number of participants; duration of intervention and follow-up;
17
18 276 date; setting; country; co-morbidity; socio-demographics; and specific category of chronic
19
20 277 condition. Where available the intervention data extracted will include frequency, intensity,
21
22 278 time and type of exercise intervention and any control or comparison groups; the number of
23
24 279 intervention groups; the type of telehealth modality used; adherence; satisfaction; and other
25
26 280 methods of exercise delivery or support used in the study. All reported outcome measurements
27
28 281 will be charted. Details of outcomes which directly inform the research questions including
29
30 282 economic viability, intervention feasibility, intervention safety (including adverse events),
31
32 283 cardiovascular risk factor indicators (including blood pressure, level of physical activity,
33
34 284 cholesterol, lipid profiles, insulin resistance) will be prioritised. Any other key findings or
35
36 285 recommendations not captured through the above process which specifically relate to our
37
38 286 research questions will also be charted.
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47 288 All papers included in the scoping review will be critically appraised. We have chosen to undertake
48
49 289 critical appraisal for two reasons. The first, to facilitate accurate identification of evidence gaps
50
51 290 which Brien, et al. (2010) highlights can be difficult without the assessment of evidence quality⁴⁵.
52
53 291 The second, is to optimise recommendations made for practice to ensure they are based on sound
54
55 292 evidence³⁹. We will use *The Cochrane Collaboration's tool for assessing risk of bias*⁴⁴ to assess
56
57 293 the bias of each individual, quantitative study. We will use the *Consolidated Criteria for*
58
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1
2
3 294 *Reporting Qualitative Research* (COREQ) checklist⁴⁶ and the *Mixed Methods Appraisal Tool*
4
5 295 (*MMAT*) – *Version 2011*^{47 48} to individually assess qualitative and mixed methods studies for
6
7
8 296 methodological rigour respectively. This critical appraisal will be carried out by two
9
10 297 independent authors who will meet to discuss and resolve any discrepancies found in their
11
12 298 assessments, with adjudication by a third author if necessary.
13
14

299

300 ***Collating summarising and reporting of results***

301 Our scoping review will be reported using the PRISMA-ScR³⁸. The results will be summarised
302 and reported to prioritise the findings relevant to the specific research questions. Quantitative
303 data and the results of individual studies' critical appraisal will be presented in tabular format.
304 Qualitative data will be analysed thematically and collated concisely into a tabular format. If
305 needed, further narrative description will be provided to aid interpretation of the results. Visual
306 or diagrammatic representation of data will occur to aid its summary or conceptualization as
307 needed.
308

309

309 To aid the synthesis of the results we will provide a narrative summary of the findings most
310 pertinent to the review's research questions. Knowledge gaps in the research evidence and
311 their implications will also be recognized through a narrative summary. Our key findings,
312 informed by the critical appraisal of individual studies will be used to make recommendations
313 for future research and practice relating to supervised exercise delivered via telehealth.
314

315

315 The breadth of research evidence included in this review enables the comprehensive mapping of
316 interventions involving supervised exercise delivered via telehealth aimed at reducing
317 cardiovascular disease risk factors. As such, caution should be taken when interpreting the findings
318 for individual patient populations. Another potential limitation of the study is the oversight of
319 relevant papers due to the exclusion of grey literature. This has been done to ensure research quality

1
2
3 320 can be assessed to optimise recommendations for practice. These and any further limitations
4
5 321 identified during the scoping review process will be acknowledged.
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10 323 ***Patient and Public Involvement***

11
12 324 There will be no patient or public involvement in our scoping review.
13

14 325

15
16 326 **Ethics and dissemination:**

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18
19 327 The findings of our scoping review will be disseminated through presentation at appropriate
20
21 328 forums or conferences. The completed scoping review will also be submitted for publication in
22
23 329 a peer reviewed journal and form part of a PhD thesis. Findings will be directly translated to
24
25 330 inform the development of a supervised exercise program delivered via telehealth that will be
26
27 331 pilot tested and evaluated in terms of effect on reducing secondary stroke risk factors. We will
28
29 332 use only secondary de-identified data in the scoping review, therefore ethics approval is not
30
31 333 required.
32

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36
37 335 **Discussion**

38
39 336 The high mortality rates and the significant burden of disease resulting from secondary stroke
40
41 337 must be addressed. Our review will explore emerging research in relation to the efficacy,
42
43 338 acceptability, safety, economics and feasibility of supervised exercise delivered via telehealth.
44
45 339 This research has the potential to provide strategies to overcome current barriers in the
46
47 340 translation of evidence for physical activity in stroke survivors to reduce stroke recurrence.
48
49 341

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51 342

52
53 343 This review will significantly contribute to the knowledge base of exercise and rehabilitation
54
55 344 delivered via telehealth. The breadth of research captured means it has implications beyond
56
57 345 stroke care to broadly inform the application of supervised exercise and rehabilitation via
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3 345 telehealth. It is anticipated that our findings will be relevant to researchers, healthcare workers
4
5 346 and policy makers at a national and international level.
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11
12 349 **Author Statement:**
13

14 350 All authors made significant intellectual contributions to the protocol. CE conceived the idea
15
16 351 for the scoping review. ERR (guarantor) and CE conceptualised and drafted the research
17
18 352 questions and study selection criteria, while CMS, EAL, NAF and AP contributed to their
19
20 353 further development. ERR developed the study methodology with EAL, CMS, NAF, AP and
21
22 354 CE providing feedback for refinement. All authors contributed to the drafting and editing, and
23
24
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26 355 approved the final manuscript.
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For peer review only

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Location in Document
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Page 1, Line 2
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	Not applicable (PROSPERO does not register scoping reviews) this is stated on Page 6, Line 96
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Page 1-2, Lines 5-34 ; Page 2, Line 38-9
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Page 18, Lines 350-355
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Page 3, Lines 56-60
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	Pages 8-9, Lines 115-161
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Page 10, Lines 168-179
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Pages 12-13, Lines 220-230 (including Box 1)
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Page 12, Lines 227-228 and Page 13, Lines 232-238
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	Details in Appendix 2, referred to on Page 13, Line 240
Study records:			

1	Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Pages 13-14, Lines 242-244
2	Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Page 14, Lines 244-251
3				
4	Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Page 14, Lines 256-268
5				
6	Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Page 15, Lines 274-280 (N.B. the protocol provides flexibility to add further data items to facilitate the iterative nature of scoping reviews)
7				
8	Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Page 15, Lines 280-286
9				
10	Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	Pages 15-16, Lines 292-298 Data synthesis not appropriate (scoping review). This information includes information on critical appraisal that will be undertaken.
11				
12	Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	Not applicable (scoping review)
13		15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2 , Kendall's τ)	Not applicable (scoping review)
14		15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	Not applicable (scoping review)
15		15d	If quantitative synthesis is not appropriate, describe the type of summary planned	Pages 16, Lines 300-313
16	Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	Not applicable (scoping review)
17				
18	Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	Not applicable (scoping review)
19				

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

Appendix 2: DRAFT search strategy

Medline

- #1 exp Telemedicine/
 #2 exp VIDEOCONFERENCING/
 #3 exp Remote Consultation/
 #4 (ehealth* or e-health* or e health* or electronic-health* or electronic health* or mhealth* or m-health* or m health* or mobile health* or mobile-health* or emedic* or e-medic* or e medic* or electronic-medic* or electronic-medic*).mp.
 #5 (videoconferenc* or video-conferenc* or video conferenc* or teleconsult* or teleconsult* or tele consult* or teleconferenc* or tele-conferenc* or tele conferenc* or videoconsult* or video-consult* or video consult*).mp.
 #6 (interactive adj ((health adj communicat*) or video* or technolog* or multimedia)).mp.
 #7 ((digital health or digital) adj intervention*).mp.
 #8 (telehealth* or tele-health* or tele health or telemedic* or tele-medic* or telemedic* or telerehab* or tele-rehab* or tele rehab* or teleconsult* or teleconsult* or tele consult* or telemonitor* or tele-monitor* or tele monitor*).mp.
 #9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
 #10 exp EXERCISE/
 #11 exp Exercise Therapy/
 #12 exp REHABILITATION/
 #13 (physiotherap* or physical therap* or physical activ* or physical train* or physical condition* or exercis* or rehab* or exercise therap* or exercise train*).mp.
 #14 10 or 11 or 12 or 13
 #15 9 and 14

CINAHL

- S13 S11 AND S12
 S12 S1 OR S2 OR S3
 S11 S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10
 S10 ((digital health or digital) adj intervention*)
 S9 (interactive adj ((health adj communicat*) or video* or technolog* or multimedia))

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3
4 S8 "videoconferenc*" or "video-conferenc*" or "video conferenc*" or "teleconsult*" or "tele-consult*" or "tele consult*" or "teleconferenc*" or "tele-conferenc*" or "tele conferenc*" or "videoconsult*" or "video-consult*" or "video consult*"
- 7
8 S7 "ehealth*" or "e-health*" or "e health*" or "electronic-health*" or "electronic health*" or "mhealth*" or "m-health*" or "m health*" or "mobile health*" or "mobile-health*" or "emedic*" or "e-medic*" or "e medic*" or "electronic-medic*" or "electronic-medic*"
- 12
13 S6 "telehealth*" or "tele-health*" or "tele health" or "telemedic*" or "tele-medic*" or "telemedic*" or "telerehab*" or "tele-rehab*" or "tele rehab*" or "teleconsult*" or "tele-consult*" or "tele consult*" or "telemonitor*" or "tele-monitor*" or "tele monitor*"
- 17
18 S5 (MH "Videoconferencing+")
- 19
20 S4 (MH "Telehealth+")
- 21
22 S3 "physiotherap*" or "physical therap*" or "physical activ*" or "physical train*" or "physical condition*" or "exercis*" or "rehab*" or "exercise therap*" or "exercise train*"
- 25
26 S2 (MH "Rehabilitation+")
- 27
28 S1 (MH "Exercise+")

Cochrane

- 32 #1 MeSH descriptor: [Telemedicine] explode all trees
- 33 #2 MeSH descriptor: [Videoconferencing] this term only
- 34 #3 "videoconference" or "video-conference" or "video conference" or "teleconsultation" or "tele-consultation" or "tele consultation" or "teleconference" or "tele-conference" or "tele conference" or "videoconsultation" or "video-consultation" or "video consultation"
- 39 #4 "ehealth" or "e-health" or "e health" or "electronic-health" or "electronic health" or "mhealth" or "m-health" or "m health" or "mobile health" or "mobile-health" or "medicine" or "e-medicine" or "e medicine" or "electronic-medicine" or "electronic-medicine"
- 45 #5 "telehealth" or "tele-health" or "tele health" or "telemedicine" or "tele-medicine" or "telemedicine" or "telerehabilitation" or "tele-rehabilitation" or "tele rehabilitation" or "teleconsultation" or "tele-consultation" or "tele consultation" or "telemonitor" or "tele-monitor" or "tele monitor"
- 50 #6 "digital health intervention" or "digital intervention"
- 51 #7 "interactive video" or "interactive technology" or "interactive multimedia" or "interactive health"
- 55 #8 #1 or #2 or #3 or #4 or #5 or #6 or #7
- 56 #9 MeSH descriptor: [Exercise] explode all trees
- 57 #10 MeSH descriptor: [Rehabilitation] explode all trees
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3 #11 "physiotherapy" or "physical therapy" or "physical activity" or "physical training" or
4 "physical conditioning" or "exercise" or "rehabilitation" or "rehab" or "exercise
5 therapy"
6
7 #12 #9 or #10 or #11
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9 #13 #12 and #8
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14 #1 exp exercise/
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16 #2 exp kinesiotherapy/
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18 #3 exp rehabilitation patient/ or exp rehabilitation medicine/ or exp rehabilitation/ or exp
19 stroke rehabilitation/ or exp athletic rehabilitation/ or exp pulmonary rehabilitation/ or exp
20 community based rehabilitation/ or exp geriatric rehabilitation/ or exp rehabilitation
21 center/ or exp heart rehabilitation/ or exp cancer rehabilitation/ or exp rehabilitation care/
22 or exp rehabilitation nursing/
23
24 #4 (physiotherap* or physical therap* or physical activ* or physical train* or physical
25 condition* or exercis* or rehab* or exercise therap* or exercise train*).mp.
26
27 #5 1 or 2 or 3 or 4
28
29 #6 exp telehealth/ or telemedicine/ or exp telerehabilitation/ or exp telemonitoring/ or exp
30 teleconsultation/ or exp videoconferencing/
31
32 #7 (ehealth* or e-health* or e health* or electronic-health* or electronic health* or mhealth*
33 or m-health* or m health* or mobile health* or mobile-health* or emedic* or e-medic* or
34 e medic* or electronic-medic* or electronic-medic*).mp.
35
36 #8 (videoconferenc* or video-conferenc* or video conferenc* or teleconsult* or tele-consult*
37 or tele consult* or teleconferenc* or tele-conferenc* or tele conferenc* or videoconsult*
38 or video-consult* or video consult*).mp.
39
40 #9 (telehealth* or tele-health* or tele health or telemedic* or tele-medic* or telemedic* or
41 telerehab* or tele-rehab* or tele rehab* or teleconsult* or tele-consult* or tele consult* or
42 telemonitor* or tele-monitor* or tele monitor*).mp.
43
44 #10 ((digital health or digital) adj intervention*).mp.
45
46 #11 (interactive adj ((health adj communicat*) or video* or technolog* or multimedia)).mp.
47
48 #12 6 or 7 or 8 or 9 or 10 or 11
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50 #13 5 and 12
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55 Scopus

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57 ((TITLE-ABS-KEY ("videoconference" OR "video-conference" OR "video
58 conference" OR "teleconsultation" OR "tele-consultation" OR "tele
59 consultation" OR "teleconference" OR "tele-conference" OR "tele

1
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3 conference")) OR (TITLE-ABS-KEY ("videoconsultation" OR "video-
4 consultation" OR "video consultation" OR "ehealth" OR "e-health" OR "e
5 health" OR "electronic-health" OR "electronic health" OR "mhealth" OR "m-
6 health" OR "m health" OR "mobile health" OR "mobile-health")) OR (TITLE-
7 ABS-KEY ("emedicine" OR "e-medicine" OR "e medicine" OR "electronic-
8 medicine" OR "electronic-medicine" OR "telehealth" OR "tele-health" OR "tele
9 health")) OR (TITLE-ABS-KEY ("telemedicine" OR "tele-
10 medicine" OR "telemedicine" OR "telerehabilitation" OR "tele-
11 rehabilitation" OR "tele rehabilitation" OR "teleconsultation" OR "tele-
12 consultation" OR "tele consultation" OR "telemonitor" OR "tele-
13 monitor" OR "tele monitor")) OR (TITLE-ABS-KEY ("digital health
14 intervention" OR "digital intervention")) OR (TITLE-ABS-KEY ("interactive
15 video" OR "interactive technology" OR "interactive multimedia" OR "interactive
16 health")) AND (TITLE-ABS-KEY ("physiotherapy" OR "physical
17 therapy" OR "physical activity" OR "physical training" OR "physical
18 conditioning" OR "exercise" OR "rehabilitation" OR "rehab" OR "exercise
19 therapy" OR "exercise training"))
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25 **Pedro**

26 Telerehab* exercis*
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